swept away.* M. Elie de Beaumont advanced the theory that sand-dunes might serve as natural chronometers, by which the date of the existing continents may be ascertained; that by observing the rate at which the particles of sand travel, we may calculate the period when the movement commenced.† Sir C. Lyell, however, doubts the correctness of this theory, observing that "this test must be applied with great caution, so variable is the rate at which sand may advance into the interior.‡

Art. V.—*On Abyssinian Tube Wells.*

By Francis Corbett, Esq.

[Read 13th July, 1874.]

These pumps were constructed of six lengths of ordinary iron piping for gas pipes, each of six feet long. Into one of these lengths was screwed a piece of solid iron, pointed, about eight inches long, and the shoulder next the pipe was made of a greater diameter than the pipe. This is for driving into the ground, and the diameter being greater than the pipe, it clears the way, especially where the holes are made in the pipe. Just above where this solid point is screwed, holes are drilled in the pipe for the water to enter, just as in any ordinary tubing for a well, for sixteen or eighteen inches in length. The number of these holes must of course be in proportion to the size of the pump, so as to admit as much water as the pump is capable of throwing. Less holes would be required in a small pump, suitable either for domestic purposes, or for a small paddock. The pumps I got Mr. Danks to adapt the pipes for were No. 6 Douglas, the largest size made by that manufacturer. They are as large as can be reasonably worked by manual labour, and the larger the pump the better, as it takes the man less time to fill the troughs. Mr. Danks' arrangement for attaching the different lengths of the piping to one another is very good, as the pipes preserve their full strength. He has a ring or hoop about three inches broad, tapped from both ends, with right and left handed internal screws. The ends of the pipes have screw threads worked on the outside of them,

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* Principles of Geology, 1867, i., p. 513.
† Géologie Pratique, p. 218.
‡ Principles of Geology, 1867, i., p. 516.

about an inch and quarter or inch and half long. The ring is screwed on to the first length of the pipe, and the second length is screwed into the ring, till the two ends of the pipes meet. By this connection the joints of the pipe become probably the strongest parts of it. The first length of the pipe, owing to the addition of the driving solid iron point, is nearly seven feet long. When this is driven into the ground, leaving only a few inches above the surface, the ring is screwed tightly on with a gas-fitter's tongs. I may here mention that I would recommend that two of these tongs should be got, because in screwing the lengths of the pipe on tightly, the part driven into the ground will turn round if not held back. When the ring is screwed fully down, the next length of the pipe is screwed into the ring, and the driving is recommenced till the end of the second length is only five or six inches above the surface, and so the work of driving goes on. I may mention that Mr. Danks recommends, that when screwing in the different joints, the screws should be smeared with white lead. I have adopted his suggestion. In order to protect the top of the pipe as well as the driving block from injury by the blows in driving, Mr. Danks has fitted a cap which screws on to the ends of all the pipes, and offers a level surface to the monkey or block. He ingeniously devised the plan of having a little block of wood inside this cap. When the cap is screwed down tight, the wood presses on on the top of the pipe, and at one and the same time prevents jar on the pipe, and prevents the screws being injured by stripping. Care should be taken never to omit putting this block in, nor to omit screwing the cap well down on it, otherwise the cap may fasten on the top of the pipe, and not screw off again, owing to the thread of the screws being injured. When one length is driven the cap is taken off and screwed on to the top of the next length, after the latter is connected with that already in the ground.

Now as regards the driving. This can be managed by any handy man about a station, with the assistance of two labourers to haul up and down the monkey, &c. The apparatus may be of the rudest kind. My arrangements are as follows: I took three pieces of quartering about eighteen feet long, and 3″ x 3.″ These were erected over the spot selected for the pump, so as to form a triangle to hold a double pulley block for hauling the driving block up and down on. For the driving block I used a piece of a gate post about nine inches square, and four or five feet long. Through this a hole was bored a few inches from one end, and a rope about sixty feet long passed through this hole. Then either end of this rope is passed from opposite sides over each wheel, or sheaf of the pulley-block, so as to come down to the ground at opposite sides, where the men who are to lift the driving block stand. The log or driving block consequently hangs on the middle of the rope when the men pull, and can be lifted about fourteen or fifteen feet from the ground. It is of course necessary to provide for the guiding of the driving block, otherwise when let drop on the top of the pipe, it would fall on one side. My arrangement for this guiding frame is two pieces of hard-wood quartering, fourteen feet long, bolted at each end to two cross pieces of batten, so as to keep them about three inches apart. The lower ends of these are sunk a few inches in the ground to keep them steady, and the upper ends are fixed to the triangle just behind where the block hangs. On the back of the log or driving block, a piece of quartering three inches wide is spiked. This has two cross-pieces of batten bolted to it. The piece of quartering passes up and down with the driving block in the opening between the sides or pillars of the guiding frame, thus keeping the driving block from falling laterally, and the pieces of batten at the back keep it from falling forward when the block falls on the head of the tube. Such is the description of the pile driving machine, which can be constructed in an hour out of the materials which are at hand on most farms and stations.

When the driving apparatus is fixed up the first length of the pipe (that with the point on it), must be placed *perfectly* vertical under the centre of the driving block. To prevent it moving, a piece of batten may be placed at top and bottom between it and the guiding frame, and the man managing the pipe may hold a piece of rope round the pipe, so as to keep it steady in its place during the driving, in order to prevent the top of the pipe going either way when struck by the monkey or driving block, which it is apt to do unless kept perfectly upright. At first the taps on the top of it should be light till the pipe gets well into the ground. When well down, there is little danger of its going to either side, but it is wise throughout to keep it steady under the blows of the monkey. If the first length is carefully attended to and kept perfectly upright, there is little trouble with all the others.

When rock or other hard substance is come to, that is when the pipe ceases to go down easily under the blows of the monkey, it should be driven no more, as the pipe would bend where it is weakened by the holes, if it got many blows after touching the rock.

When the pipe gets down to a depth where water may be expected, it is well to let a plummet down into it to ascertain if there is water. If so, and it has risen high, it may be well to screw on the pump and try if it is merely soakage water, or whether it has come on a spring. With the first pump I put down I found at twenty feet that there was eight or nine feet of water, and I tried the pump on it. I afterwards drove it to a depth of twenty-six feet, and the water rose twenty feet in the tube; notwithstanding, however, their being so much water in the tube, it came up at first only slowly, and there was great pressure on the handle of the pump. It required several hours pumping before the water became clear and came with a free flow. But the success of the pump may be judged from the fact that I fitted first two troughs containing each 594 gallons connected together by a tube, and the two were filled in an hour and a quarter, the pump throwing out the water as fully at the end as in the beginning; showing that the springs were fully equal to the pipe, of which the bore is two inches.

The doubt I had about tube wells being equal to pumps which have a large reservoir of say six feet square, was that there was no reserve of water, and that they would exhaust under half an hour's pumping; but I now see that if you get a good spring it is quite equal to the pump with storage. Moreover, where there is a good spring, you can by the tube well get down to the bottom of it; whereas in well sinking, the men are obliged to cease working before they get down as far as would be desirable, by reason of the flow of water.

At first a great deal of mud comes up, then sand. The water gradually clears till it is as free from sediment as any of the other pumps.

The second pump I put down was in a more doubtful spot than the first. It had to be pumped a good while before water came. For a good while again it only gave about a gallon of thick water a minute. The pressure on the pump was so great that it was quite plain it was drawing the water through the ground, that it was in fact tearing springs open by main force. As the pumping went on, the water would clear for a while, and then apparently a fresh spring would be opened, and thick water would come again; but the flow improved gradually. After nearly an hour's pumping, it yielded a gallon every seven or eight seconds, and after that it required four or five hours' pumping before there was as full a flow of water as the pump was capable of throwing.

The third of the pumps which Mr. Danks has made for me, has been down twice without getting on a spring. It came once on rock at twelve feet from the surface, where there was no spring; next it came on rock at a depth of twenty-one feet. Here there was no water either. So great is the pressure of the pump at the bottom, when the pump is tried to see if it will open any springs, that it drew mud up into the tube to a height of nine feet. It is of course no fault of the pump that it cannot get water everywhere. In these two cases, the loss was only that of three men working four or five hours, whereas sinking two wells and slabbing them, of twelve feet and twenty-one feet respectively, would have been a serious loss. The putting down of the pipe for one of these pumps is less labour than boring, and one ascertains for certain whether there is water or not.

There is not much difficulty in lifting the pumps. Get a piece of quartering for a lever, say 15 feet long; put a bullock-chain round the pipe, with the hook to run on the chain; roll the other end round the lever. When the end of the lever is lifted, the chain tightens on the tube so thoroughly that it will not slip, and the tube will draw with a strong lift of the lever. When the end of the lever is lowered after the first lift of the pipe, the chain round the pipe will slip down; and when the lever is again lifted, it will tighten round the pipe, so that it will take the pipe up gradually without any re-adjusting or re-fixing of the chain.

I have heard it stated that tube wells collapse or cave in after a time. I think, however, considering how clear the water is which comes up in those I have down, that it would take a long time to bring about such a result. Neither can I see why, if any falling in took place, it should not be pumped out as well as the mud and sand were in the first instance. But even if either of those I have did cave in after a few years, it is only a forenoon's work to lift them and drive them again a few yards off—which, of course, I would do, having ascertained that there was abundance of water there. At the worst, only the labour of driving the tube is lost, as the pump tubes can also be put down in an ordinary well if required afterwards. The piping is a little stronger and more carefully fitted than that for an ordinary well.

A No. 6 Douglas pump costs £5 5s., and when a man gets handy at putting them down, fifteen shillings or a pound will cover the expense of driving them. Certainly no one ought to be without a good supply of water in his paddocks in summer when he can bring it up from a depth of 30 feet for, say, £6 10s. Most of the waterholes one sees are so filthy and impure in summer that it is enough to poison the milk, and to bring disease on and poison the blood of the animals who drink it. If animals have foul water we must expect fluke and pleuro. My cattle will not go even to waterholes supplied from springs when they can get the pure water in the troughs; and they drink vastly more of the pure water than they would of the impure.

Art. VI.—*On Cremation.* By S. W. Gibbons, F.C.S.

[Read 13th July, 1874.]

Art. VII.—*Is the Eucalyptus a Fever-destroring Tree?*

By J. Bosisto, Esq.

[Read 10th August, 1874.]

In many places on the continent of Europe and elsewhere, experiments have been made to acclimatise our *eucalypti*, more especially the "*globulus*," or blue-gum species.

The rapidity of its growth, its pretty ovate, and afterwards lanceolate leaf, its early maturity, together with its power to absorb considerable moisture, and to permeate the air with its peculiar odour, led to the belief that this tree, attractive in itself, exerts a beneficial influence upon malarious districts. But this species, if considered apart from its *congéners*, does not supply sufficient information so as to arrive at anything like a satisfactory answer.

In the consideration of the question, is the *eucalyptus* a fever-destroying tree? or, in other words, does it tend to lessen malaria or to destroy miasmatic poison? we propose to regard the whole of the *eucalypt* vegetation.

If we journey from Melbourne or from other centres of